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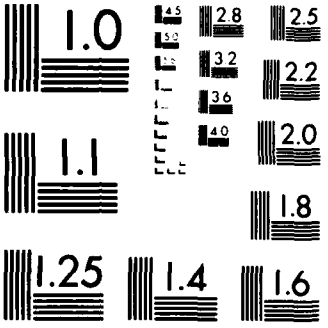

Expert systems in contract management.
A pilot study

by E G Trimble
R J Allwood
F C Harris

University of Technology
LOUGHBOROUGH
Leics LE11 3TU
United Kingdom

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Expert systems; knowledge bases; Imprecision; Rule based systems; Resource oriented scheduling;

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

It is reported that
Linking of an expert system and a planning program has been achieved,
There are now four collaborating contractors,
Knowledge is being assembled within two of the collaborating companies,
Six system shells have been evaluated,
Extensions to the materials handling application have been explored,
Several important conclusions were drawn from a visit by Mr Frank Kearney
A "Teach-in" will be held ~~re~~ for future expert system applications.

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Report for the US Army research development and standardization group (UK).
Contract no. DAJA45-84-C-0024
Requisition no. R & D 4613-EN-01

Subject Expert systems in contract management. A pilot study

Principal investigator Professor E G Trimble
Associated investigators Dr R J Allwood. Dr F C Harris

SECOND INTERIM REPORT (as at 1 December 1984)

1. Actions between 1 June 84 and 1 December 84

1.1 In July 1984 the principal investigator visited CERL and demonstrated to Mr Frank Kearney and his colleagues two programs that have been developed named GES and ROS. The former is a rule based expert system; the latter is a program to perform project scheduling under an approach known as resource oriented scheduling. It will also perform line of balance calculations.

1.2 To demonstrate feasibility, these two programs have since been linked using the knowledge base described previously as "the demonstration application". This now operates within GES and advises on the appropriate form of scheduling. If the advice is to use resource oriented scheduling or line of balance the user is invited to load directly the ROS program. If he wishes to do so and enters Y in response to the appropriate question the ROS program is loaded ready for use.

1.3 A fourth contractor namely Tarmac Ltd has agreed to collaborate with us in the development of the materials handling application.

1.4 An internal seminar has been conducted to explore the mechanism by which the knowledge base is best obtained from human experts. The participants included a behavioural scientist namely Dr J Cullen. The seminar concluded that our previous intention to offer the expert a draft system and invite him to comment could suffer from the defect that it would create prejudice in the mind of the respondent and hence could distort the responses. It was considered better to explore the expert's general approach and build a system which reflects that expert's views rather than those of the people previously involved.

A visit to Stanford University (Dr Raymond Levitt) has confirmed that this more open approach was adopted in the formulation of the rules for Prospector.

1.5 We have conducted exploratory sessions with Tarmac and Taylor Woodrow to establish rule bases that reflect their approach to the Materials handling application. For the time being we are deferring contact with Costain and IDC in the hope that, when we

start with these contractors, our previous experience will help to ensure effective and un-distorted responses.

1.6 We have examined six shell systems and the manuals for five more and we are continuing our evaluation of available software. Our examination of Micro Expert indicated that its method of dealing with imprecision can lead to misleading answers. We have also concluded that a successor to Micro-Expert known as SAVOIR should be adopted for our further work provided that adjustments can be made to its method of dealing with imprecision. We are in negotiation with ISIS Ltd, the author of both programs, to secure an improved module.

1.7 We have explored the possible extensions of the Materials handling application and concluded that these could take the form of

- Taking account of ancillary activities notably the cladding and finishes.
- Embodying economic calculations, based on DCF, to evaluate the solutions shown by the basic expert system to be most promising.
- Incorporating a data base facility to store the relevant performance data.
- Taking account of formwork strategy and the movement of support tables.
- Examining the impact of the choice of equipment, formwork strategy and construction method on the project schedule and taking this into account in an iterated assessment of the economic considerations.

We believe that these extensions are outside the scope of the present study.

2. Visit by Mr Frank Kearney

During the period under review, the investigator arranged for Mr Kearney to visit the UK for presentation and discussions at

- The University of Reading
- Imperial College of Science and Technology (part of London University)
- A private meeting of the Science and Engineering Research Council
- The University of Leeds
- The University of Technology, Loughborough
- Heriot-Watt University Edinburgh
- The Turing Institute, Glasgow

This visit was separately funded and will be separately reported. It is mentioned here as the dialogue which occurred and the conclusions that were reached are relevant to the present study. In particular it was concluded that efforts should be directed towards

- The identification of suitable domains
- The methods of representing knowledge and of dealing with imprecision
- The methods of acquiring a reliable knowledge base for the defined domain.

These important conclusions are being taken into account in our current work and future plans.

3. Future work

We plan to continue our work on Materials handling with Tarmac and Taylor Woodrow and to extend the work to Costain and IDC provided that these companies confirm their willingness to collaborate. In implementing this work we shall monitor carefully the nature of the problems that arise in obtaining the knowledge base so that we can more appropriately specify a future study on this aspect.

We are making arrangements to hold a "Teach-in" for senior representatives from the construction industry. At this event we shall explain and demonstrate the use of expert systems and, by means of syndicate discussions, seek proposals for future applications. We hope to be able to devise criteria by which to assess suitability and thus to be able to offer a screened list in our final report.

Our evaluation of expert system shells will continue and may extend beyond those that can be mounted on micro computers.

In our first interim report we said that we shall explore the feasibility of developing a matrix of applications. We now see this as a very long-term objective. We shall make reference to this in our final report but do not expect to study the subject in any detail within the current project.

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